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PHOTOGRAPHIC HISTORY OF FOREST ENCROACHMENT IN SEVERAL RELICT PRAIRIES OF THE EDGE OF APPALACHIA PRESERVE SYSTEM, ADAMS COUNTY, OHIO[1]

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ABSTRACT. Forest encroachment into several relict prairies located within the Edge of Appalachia Preserve System, Adams County, Ohio, was studied using a series of U.S.D.A. aerial photographs taken in 1938, 1950, 1965, and 1971. The corresponding photointerpretations reveal increased herbaceous cover after abandonment of cultivated field sites and illustrate the conversion of prairie and prairie glades to forest. All sites studied exhibited decreased percentage of prairie from 1938–1971.

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INTRODUCTION

The Edge of Appalachia Preserve System is a series of preserves (The Wilderness, Lynx Prairie, Buzzardroost Rock, Red Rock, Hanging Prairie, Cave Hollow, Abner Hollow, and the Rieveschl Preserve) extending from approximately 3 km north of Lynx in Adams County, Ohio, transversing land on the east side of Ohio Brush Creek and ending near the Ohio River (fig. 1). The preserves lie along the corresponding border of 2 of Ohio's physiographic regions, the Bluegrass Plateau and the Appalachian Plateau (Lafferty 1979). As a result, the Edge of Appalachia consists of varied geologic and soil structures creating a diverse assemblage of forest community types and relict communities such as prairies, cedar barrens, and *Arbor vitae* forests (Braun 1928). These communities harbor several rare and endangered plant and animal species. Consequently, the Ohio Chapter of The Nature Conservancy has been active in acquiring land in this area and establishing preserves, many of which have been deeded to The Cincinnati Museum of Natural History for care and maintenance.

Forest encroachment into relict prairies of the Edge of Appalachia was studied previously at the Lynx Prairie Preserve and at a nearby privately owned property (Annala et al. 1983). A series of U.S.D.A. aerial photographs (1938–1971) revealed rapid conversion of prairies to forest. Using the same techniques, we examined forest encroachment into other relict prairies lo-

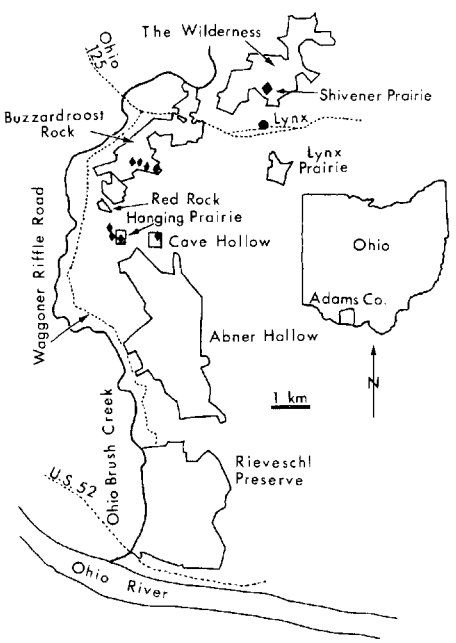

FIGURE 1. Location map of the preserves within The Edge of Appalachia Preserve System, Adams County, Ohio. Diamonds represent approximate location of the relict prairies.

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cated at The Wilderness Preserve, Buzzardroost Rock, Hanging Prairie, and Cave Hollow (fig. 1).

STUDY SITE

The Wilderness (The Charles A. Eulett Preserve) is located approximately 1 km north of Lynx, in Adams County, Ohio (fig. 1). Buzzardroost Rock (The Christian and Emma Goetz Nature Preserve) is located on the east side of Ohio Brush Creek approximately 2 km southwest of Lynx (fig. 1). Both preserves are located on the Lynx Quadrangle, 7.5 min series topographic map of the U.S.G.S.

Hanging Prairie is located on the eastern slope of Iron Kettle Hollow approximately 4.5 km southwest of Lynx (fig. 1). The nearby prairies of Cave Hollow are located north of Cave Hollow just east of Hanging Prairie (fig. 1). These areas are located on the Concord Quadrangle (Ohio-Kentucky) 7.5 min series topographic map.

The soils of these relict prairies are derived from Peebles dolomite and are generally shallow and poorly developed. These prairies contain numerous tallgrass prairie species including: big bluestem (*Andropogon gerardii* Vitman), little bluestem (*Schizachyrium scoparium* (Michx.) Nash), Indian grass (*Sorghastrum nutans* Nash), switchgrass (*Panicum virgatum* L.), and sideoats-grama grass (*Bouteloua curtipendula* (Michx.) Torr.).

METHODS AND MATERIALS

Duplicate negatives of the aerial photographs were obtained from the U.S.D.A. Aerial Photography Field Office in Salt Lake City, UT, and the National Archives in Washington, DC (table 1). Photographs were printed at the following nominal scales: The Wilderness and Buzzardroost Rock, 1:4200; Hanging Prairie and Cave Hollow Prairie, 1:6100. The methods used for interpreting the photographs and for determining the percentage of land supporting prairie for each preserve were those of Annala et al. (1983).

The blackened areas on the photointerpretations represent open areas of herbaceous cover which may include both weedy and prairie species. White areas represent forest or woodland. Stipple marks indicate the various degrees of invasion by woody species into the glades: light stippling represents glades with a greater degree of invasion, dark stippling represents glades with lesser amounts of woody invasion. On-site slope measurements were determined using a Brunton clinometer/compass from a minimum of 6 points per prairie site.

RESULTS

Most of the present-day prairie and prairie glade areas at The Wilderness (The Shivener Prairie, fig. 2) and Buzzardroost Rock (fig. 3) are located on previously cultivated or pastured land. Even though prairie species may have been present prior to agricultural disturbance, this cannot be determined from the aerial photographs available. With the abandonment of these agricultural lands, herbaceous species colonized the area, as illustrated on the 1950 photointerpretations (fig. 2,3).

TABLE 1

Aerial photograph identification numbers and sources.

Location	Flight Date	ID No.	Source
Wilderness	20-viii-38	BBV-5-52	National Archives
	13-x-50	BBV-3G-122	USDA Aerial Photograph
	25-x-65	BBV-1FF-160	USDA Aerial Photograph
	20-x-71	BBV-1MM-249	USDA Aerial Photograph
Buzzardroost Rock	20-viii-38	BBV-3-125	National Archives
	13-x-50	BBV-3G-168	USDA Aerial Photograph
	25-x-65	BBV-1FF-162	USDA Aerial Photograph
	20-x-71	BBV-1MM-208	USDA Aerial Photograph
Hanging Prairie-Cave Hollow	20-viii-38	BBV-3-103	National Archives
	13-x-50	BBV-36-170	USDA Aerial Photograph
	25-x-65	BBV-1FF-162	USDA Aerial Photograph
	20-x-71	BBV-1MM-206	USDA Aerial Photograph

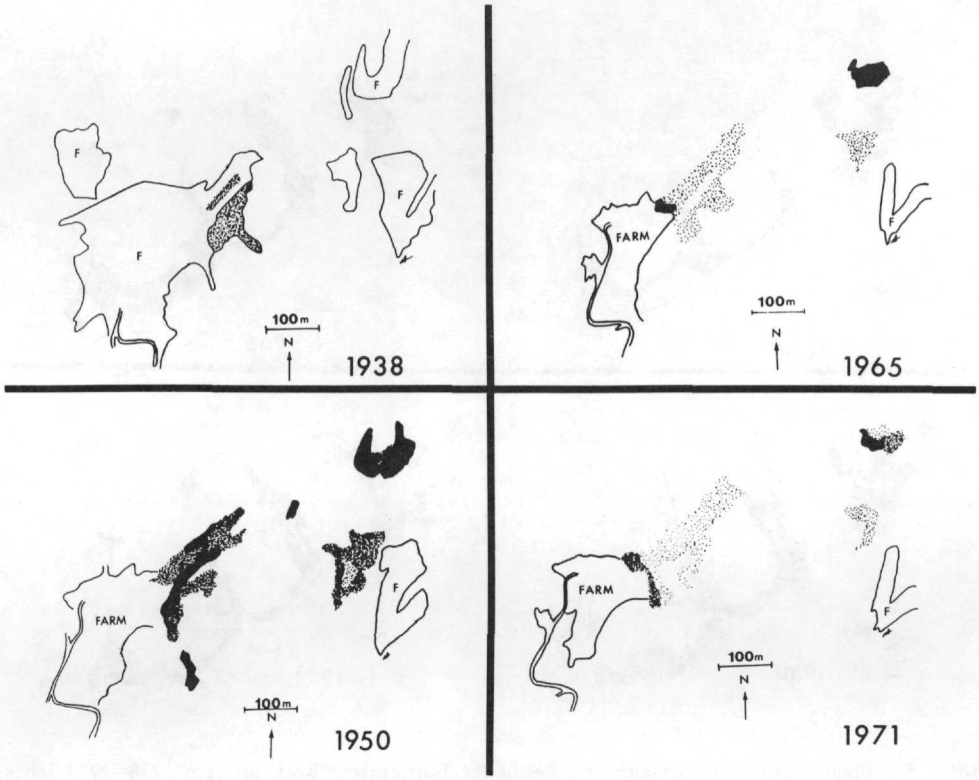

FIGURE 2. Photointerpretations for The Shivener Prairie of The Wilderness preserve 1938–1971 series. F = field, Black = open prairie, White = forest, dark stipple = prairie glade with a small degree of woody invasion, light stipple = prairie glade with a greater degree of woody invasion.

Not only do The Wilderness and Buzzardroost Rock photointerpretations exhibit increased herbaceous cover after abandonment of field sites, but they illustrate the conversion of the 1938 prairie and prairie glade sites to forest in later years. (Compare the far northwest corner area on the Buzzardroost photointerpretations from 1938 to 1971.)

Forest encroachment resulted in a decreased percentage of original prairie throughout the 33-yr period. From 1938 to 1950 there was an increase in herbaceous cover in abandoned field sites. The loss of original prairie coupled with the development of secondary succession prairies resulted in an apparent slower rate of forest encroachment prior to 1950 (fig. 4). Subsequently, the entire area was subject to invasion by woody species, and thus a more rapid decrease in the percentage prairie occurred (fig. 4).

After comparing aerial photographs with topographic maps, Hanging Prairie was found to consist of 3 lobes of a hill face as determined by drainage channels. This is illustrated on the 1938 photointerpretation (fig. 5). Therefore, as woody species invaded from the surrounding forested area, they became established along these drainage channels further separating the prairies. This can be seen by comparing the 1950 and 1965 photointerpretations. In 1950, 3 large prairie areas were present. By 1965, 4 smaller areas were apparent. The separation of the middle prairie into 2 smaller prairies occurred along a drainage channel.

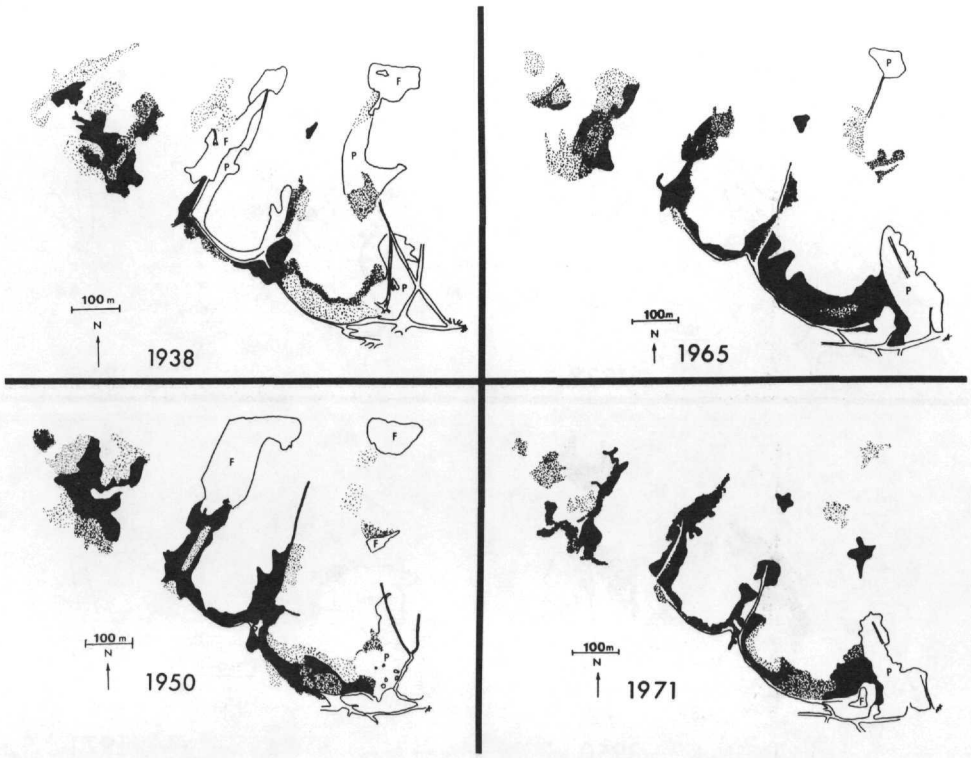

FIGURE 3. Photointerpretations for the prairies of the Buzzardroost Rock preserve 1938–1971 series. F = field, P = pasture.

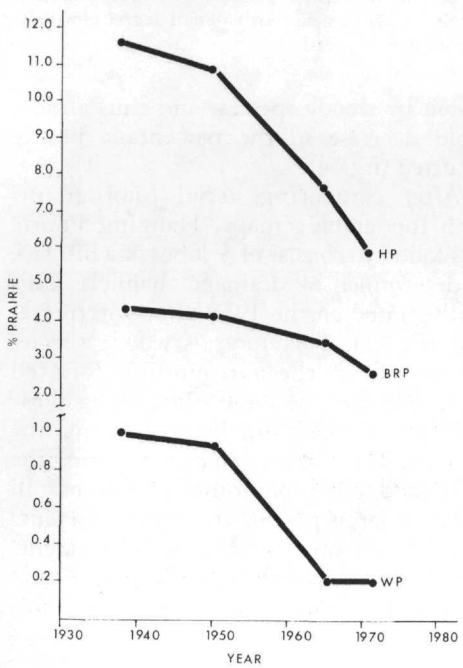

FIGURE 4. The percentage of land supporting prairie from 1938 to 1971 at The Wilderness (WP), Buzzardroost Rock (BRP), and Cave Hollow and Hanging Prairie combined (HP). Herbaceous cover on abandoned field and pasture sites was not included in this determination.

The transition from prairie to forest on the Cave Hollow prairies (fig. 5) was similar to the prairies at Buzzardroost Rock and Hanging Prairie. The abandoned field indicates colonization of herbaceous and woody species. (Compare the 1965 and 1971 photointerpretations, fig. 5.) The steepest sloped area of the Cave Hollow prairies, located in the far southeast corner of the photointerpretation (fig. 5), indicates a comparatively slower rate of forest encroachment. Fire may have aided in slowing the rate of forest encroachment, since site visits to this prairie revealed several charred tree stumps throughout the area.

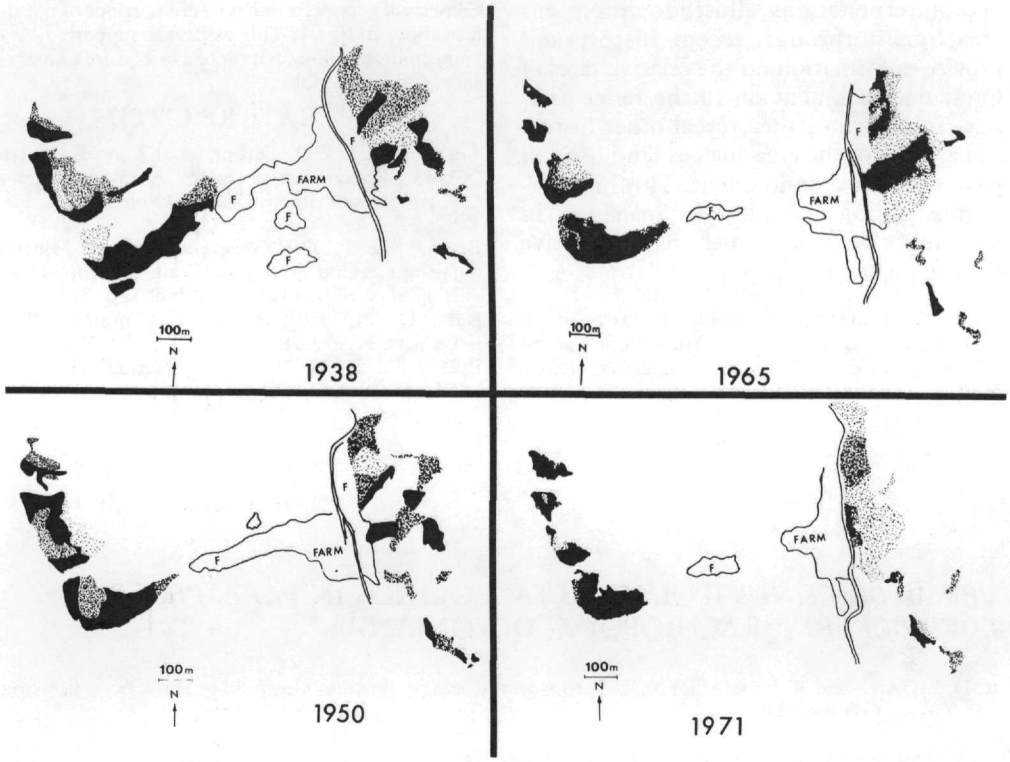

FIGURE 5. Photointerpretations for Hanging Prairie, located west of the farm, and for the prairies of Cave Hollow, located east of the farm, 1938–1971. F = field.

Site inspection of each relict prairie revealed that all sites exhibited some degree of forest encroachment. Of all the sites, The Shivener Prairie in The Wilderness exhibited the greatest degree of woody invasion. The prairies of Buzzardroost Rock, Hanging Prairie and Cave Hollow revealed both scattered individuals and expanding groves of trees and shrubs, especially along drainage channels.

The most common invading woody species were: red cedar (*Juniperus virginiana* L.), scrub pine (*Pinus virginiana* Mill.), red bud (*Cercis canadensis* L.), and various species of Oak (*Quercus* spp. L.).

The range of slope measurements for the prairies of each preserve were similar: The Wilderness 2–20°, Buzzardroost Rock 10–24°, Hanging Prairie 9–22°, Cave Hollow 17–33°. Soil erosion was found commonly on sites with steep slope, seepage areas, and locations of previous agricultural activity.

DISCUSSION

Aerial photographs reveal many of the present-day prairie remnants have been established (or reestablished) on cultivated or pastured land. Other areas were prairie in 1938 and indicated no evidence of agricultural disturbance. However, all the relict prairies studied exhibited some degree of forest encroachment. The edaphic and topographic conditions of each prairie remnant likely are responsible for the different rates of woody invasion identified. However, fire may have been responsible for slowing the rate of forest encroachment evident at a prairie above Cave Hollow.

It has been apparent that woody invasion is a problem in these relict prairies (Braun 1928, Burt 1971). Aerial photographs and

photointerpretations illustrate forest encroachment through recent history and provide information on the relative rates of forest encroachment on to the relict prairies. In addition, they reveal other historical aspects of the area such as land use and recovery after abandonment. This information is aiding the preserve managers in selecting the areas which require active management programs.

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